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[MED 23: Domestic and Commercial Gas Burning Appliances]

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Indian Standard

SPECIFICATION FOR COMMERCIAL GAS BAKING AND ROASTING OVEN

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 5

October 1974

Indian Standard
SPECIFICATION FOR COMMERCIAL GAS BAKING AND ROASTING OVEN

Domestic and Commercial Gas Burning Appliances (Pressure Type)
Sectional Committee, CPDC 23

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Indian Standard
SPECIFICATION FOR COMMERCIAL GAS BAKING AND ROASTING OVEN

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 March 1974, after the draft finalized by the Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee had been approved by the Consumer Products and Medical Instruments Division Council.

0.2 In preparing this standard, assistance has been derived from USAS Z21.28-1967 ' USA Standard for commercial gas baking and roasting ovens ' issued by United States of America Standards Institute.

0.3 This standard is one of the series of Indian Standards on domestic and commercial gas burning appliances (pressure type) used with liquefied petroleum gases. IS : 5116-1969* is a necessary adjunct to this standard. Should, however, any deviation exist between the requirements given in IS : 5116-1969* and those of this standard, provisions of the latter shall apply.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies constructional, operational and safety requirements and performance requirements for commercial gas baking and roasting ovens of capacities more than 100 dm^3, intended for use with liquefied petroleum gases at 30 gf/cm^2 gas inlet pressure. They may be composed of one or more sections or units, as follows:

a) *Cabinet Ovens* — A stationary deck oven having more than one deck heated by a single burner or group of burners.

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*General requirements for domestic and commercial equipment for use with LPG.

†Rules for rounding off numerical values (*revised*).

b) *Sectional Oven* — A single stationary deck oven or one composed of one or more independently heated stationary decks.

c) *Reel-Type Oven* — A single oven having trays moved by mechanical means.

NOTE — The capacity of the oven shall be the area of inner surface of the oven door in square decimetres multiplied by the total inner depth of the oven in decimetres measured from the front to the rear wall of the oven.

1.1.1 For convenience, this standard has been divided into three sections as follows:

Section 1	Construction
Section 2	Performance
Section 3	General

2. TERMINOLOGY

2.1 For the purpose of this standard, the relevant definitions given in IS : 6480-1971* shall apply.

SECTION 1 CONSTRUCTION

3. GENERAL

3.0 In addition to the relevant constructional requirements given in Section 1 of IS : 5116-1969†, the requirements given in **3.1** and **3.2** shall apply.

3.1 All parts shall be substantial to the extent that they will not break, warp, distort or be damaged under normal and reasonable conditions of handling and usage.

3.2 No pressure regulator shall be included as a part of the oven.

4. MATERIAL

4.1 The relevant requirements of material as specified in Section 1 of IS : 5116-1969† shall apply.

5. DESIGN FOR MAINTENANCE

5.0 In addition to the relevant requirements of design for maintenance given in Section 1 of IS : 5116-1969†, the requirements given in **5.1** to **5.4.2** shall apply.

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*Glossary of terms relating to domestic and commercial gas-burning appliances.

†General requirements for domestic and commercial equipment for use with LPG.

5.1 Burners, mixers, valves, thermostats, orifices, burner ignition devices, door springs and other accessories and controls, which may require cleaning, repair, adjustment or replacement in the field, shall be readily accessible from the front of the appliance for cleaning, adjustment repair and replacement without the necessity of disconnecting the appliance from the gas supply. No special tools shall be required for making adjustments. Removal of a manifold panel is permissible.

5.2 Double coaxial orifices, if provided, shall be provided for each main burner and shall be supplied ready for operation.

5.3 Construction shall be such that final burner orifice and primary air adjustments can be made with the burner in place of operation.

5.4 Electric components requiring field adjustments or calibration shall be readily accessible when the appliance is installed in accordance with the manufacturer's instructions. If the operation of the appliance is necessary to make such adjustments, means for making the adjustments shall be possible without exposing electrically live parts, disturbing wiring, and without the necessity of manipulating tools within any burner compartment.

5.4.1 By direct or indirect means, it shall be possible to ascertain whether each electrical control component is functioning with the appliance installed in accordance with the manufacturer's instructions without disassembly of the appliance to a degree which would render it inoperative.

5.4.2 Means shall be provided for changing fuses and lamps with the appliance installed in accordance with the manufacturer's instructions without exposing electrically live parts, except screw shells or clips of lamp holders and fuse holders. Partial, disassembly for this purpose is permissible provided wiring is not exposed in such a manner as to possibly be damaged or have strain applied to connections during servicing. The same conditions apply to normal cleaning of the appliance.

6. WORKMANSHIP AND FINISH

6.0 In addition to the relevant requirements of workmanship and finish as given in Section 1 of IS : 5116-1969*, the requirements given in **6.1** to **6.5** shall also apply.

6.1 The general construction and assembly shall be of a neat and workmanlike character with parts well fitted and bolts or other fasteners drawn up tightly to give rigidity. Any exposed edges which might come in contact with hands during normal usage or adjustment shall be smooth.

6.2 The oven shall be so designed that it remains stable and shall not be easily overturned.

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*General requirements for domestic and commercial equipment for use with LPG.

6.3 Any rack or baking tray fitted inside an oven shall not tip down excessively when it protrudes from the oven for two-thirds of the way and a weight of 10 kg is placed in the middle of it.

6.4 Construction of portable ovens which are designed to be used with or without bases or legs shall be such that the combustion shall not be effected when the legs are detached or the base removed and the oven is set directly on the floor.

6.5 Oven shall be level and shall not rock when placed on a level surface.

7. GAS TAPS

7.0 In addition to the relevant requirements of gas taps as given in Section 1 of IS : 5116-1969*, the requirements given in **7.1** shall apply.

7.1 The taps of separate pilot valves shall be substantially different from those of the main burner valves by its shape and colour.

8. INJECTOR JETS

8.0 In addition to the relevant requirements of injector jets given in Section 1 of IS : 5116-1969*, the requirements given in **8.1** shall apply.

8.1 Orifice spuds and orifice spud holders shall be constructed of metal melting at not less than 425°C.

9. BURNERS

9.0 In addition to the relevant requirements of burners specified in Section 1 of IS : 5116-1969*, the requirements given in **9.1** to **9.9** shall also apply.

9.1 Main burners and mixer tubes shall be properly placed and securely positioned so that the burners will not twist, slide or drop out of position while in service. This shall be accomplished without the use of bolts, cotter pins or screws within the burner compartment. The construction shall be such that the burners cannot be installed in any position other than their correct position.

9.2 The design and material used in the construction of burners and their supports shall be such that neither the burner nor its support will sag, distort or melt; nor shall they get corroded, or their protective coating get damaged to such an extent that the base metal is exposed, or show leakage of gas during any of the tests specified herein or when the burner is operating and the flame burning within the mixer tube or burner head.

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*General requirements for domestic and commercial equipment for use with LPG.

9.3 Main burners and pilot devices or any assembly thereof shall be easily removable and replaceable through an access opening without disconnecting threaded joints other than those of union type. Simple disconnections, such as removal of a readily accessible manifold pipe by disconnecting a union, shall be permitted if the appliance is equipped with a manual main control valve located on the inlet side of such a connection. Disconnection, removal and reassembly shall be accomplished without the use of special tools or requiring tool manipulation within the burner compartment.

9.4 The joints when used in the pressure zone or in the burner head of a burner assembly, shall be gas-tight and shall not depend on set screws, cement or other sealing materials for mechanical strength or gas-tightness, except where such joints form part of the port area. The burner head shall be of a single casting or the joints shall be welded, brazed, bolted, screw-jointed or of any equally rigid and gas-tight construction.

9.5 Burner made up of two or more parts shall have joints between parts made tightly and permanently, and the burner shall be easily removable as one piece.

9.6 Ribbon burners shall be so constructed that the ribbon assembly can be easily removed, thoroughly cleaned and easily and correctly reinstalled in the field without the use of special tools.

9.7 When air shutters are used, burner mixer heads shall have flat faces smoothly finished.

9.8 Lighter arms, if employed, shall be cast or formed integral with burners; if necessary to make them separately, they may be attached to burners by either a threaded joint tightly drawn up, or a machined joint of tight construction permanently secured by riveting, bolting or by a bolted flange.

9.9 When ports are used to accomplish ignition between adjacent rows of ports or adjacent burners, flame carry-over shall be effected by more than one series of ports.

9.10 Bodies of burners (including mixer head, mixer tube and burner head) shall be of substantial and durable construction. They shall be made of metals having melting point above 788°C.

9.11 Wire gauzes shall not be used within the burner.

9.12 Ports shall be machined or otherwise accurately made.

9.13 Bolt holes shall not intersect gasways unless adequate provision is made to assure permanent gas-tightness.

10. BURNER SUPPORTS

10.1 Burner supports shall be so constructed that they will keep the burners in their proper position.

10.1.1 Cast iron burner supports shall not be riveted or welded in place.

10.2 Burner supports shall not interfere with any flames.

10.3 Ceramic radiants shall be so supported that the ceramics are positioned at a uniform distance from the burner and they will not be dislodged in service.

10.3.1 Supports for ceramic radiants shall be of rigid construction, of durable and heat-resistant metal and shall be bolted, riveted or spot-welded in place. Cast iron supports shall not be riveted or welded.

11. BASE, LEGS AND FRAME

11.1 Band iron, angle iron or other structural shapes used in the construction of base and frame shall have joints securely riveted or welded together, or to the body sides.

11.2 Cast bases and frames, when not cast in one piece, shall have joints securely fastened to give effectively a one-piece construction.

11.3 Legs shall be rigidly held in place.

11.4 Detachable legs which are not interchangeable shall be permanently identified with reference to proper location, unless the shape and dimensions are such as to preclude wrong assembly.

11.5 When legs are provided, suitable levellers shall be provided on appliances for battery installation.

12. STRENGTH OF APPLIANCE

12.1 The oven shall support without breakage or apparent damage for 15 minutes, a load equal to the weight of the oven and appurtenances, or a load of 180 kgf, whichever is greater, uniformly applied at the top. After the load has been supported for 15 minutes, it shall be removed. No breakage or deformation shall be observed after the test.

12.2 The materials used and the construction and assembly of the body of the oven shall be such that the application of a horizontal force of 180 kgf applied to the uppermost member of the body or body frame related to the base shall not result in a temporary deflection exceeding 3 mm in the direction and plane of the horizontal force. Compliance with this requirement shall be determined by the method given in Appendix A.

13. PILOT BURNERS AND SAFETY SHUTOFF DEVICES

13.0 Commercial baking and roasting ovens shall be equipped with a pilot burner and safety shutoff device. In addition to the requirements given in **12** and **13** of IS : 5116-1969*, the requirements given in **13.1** to **13.5** shall also apply.

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*General requirements for domestic and commercial equipment for use with LPG.

13.1 Pilot burner and safety shutoff device assemblies having input ratings in excess of 250 kcal/h shall automatically shutoff the gas to all burners, including pilot burners, if the means of ignition becomes inoperative.

13.1.1 Pilot burner and safety shutoff device assemblies having input ratings of 250 kcal or less need not be of the complete shutoff type.

13.2 Pilot burner and safety shutoff device assemblies shall be so installed that the ports of the pilot burner and operating mechanism of the safety shutoff device will not be obstructed by falling scale, lint or dirt in normal operation.

13.3 Pilot burners shall be so designed and installed that the relative position of the pilot and main burners will be maintained constant. Mounting of the pilot or main burners directly or indirectly on members that may warp in service with resulting misalignment between pilot burner and main burners shall not be considered as complying with this provision.

13.4 When a separate pilot burner is used, the design of the control system shall be such that gas cannot be admitted to the main burner while the pilot burner is being lighted and until the safety shutoff device will remain in its normal open position.

13.5 The temperature of a safety shutoff device while conducting the wall and floor temperature test shall not exceed a temperature of 12°C below that temperature for which the device is designed.

14. GAS THERMOSTAT

14.0 In addition to the requirements given in **14** of IS : 5116-1969*, the requirements given in **14.1** to **14.5** shall apply.

14.1 Thermal elements and capillary tubes shall be so located or protected as to assure against mechanical damage in normal use.

14.2 Thermostat dials shall be provided with temperature markings.

14.3 The thermostat's body temperature shall be limited to 80°C except for the thermostats supplied by the thermostat manufacturer for operation at higher temperatures.

14.4 Thermostat capillary tubes and bulbs shall be constructed of steel or material of equivalent durability.

14.5 A temperature indicator to indicate the temperature inside the oven may also be provided.

15. PRIMARY AIR CONTROL

15.1 When adjustable means are provided for control of primary air to the main burners, they shall be so constructed as to permit the adjustment of flames to yellow tips and to lifting, a hard flame or flash back. The range of adjustment of flames from yellow tips to lifting hard flames or flash back shall be easily obtained and of reasonable magnitude.

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*General requirements for domestic and commercial equipment for use with LPG.

15.2 Means shall be provided to fix air shutter securely in any desired position. Such means shall be conveniently accessible for adjustment with the burners in place and in operation and shall be so located as not to interfere with the adjustment of orifice caps when used.

15.3 Air shutters shall have a corrosion resisting finish except when the type of material or construction employed will prevent sticking or corroding in position.

16. FLUE COLLARS AND FLUE BOXES

16.1 The design of ovens shall be such that the products of combustion from all burners are carried out of the appliance through a single flue outlet. This shall not be interpreted as to preclude venting of separate sections or burners into a common manifold from which the products of combustion are vented through a single flue outlet.

16.2 A suitably designed flue collar shall be provided at the flue outlet from the appliance.

16.3 The flue collars shall be so designed that adequate escape for the flue gases is provided when it is covered with a flat object.

16.4 Provisions shall be made to assure a firm support of the draught hood or flue pipe to the flue collar.

16.5 Adequate means shall be provided to prevent the restriction of the flueway by attachment of a draught hood or flue pipe to the flue collar.

17. DECKS

17.1 Decks shall be horizontal or have an upward slope of not more than 10 mm per metre from the door.

17.2 Decks shall support, without permanent deformation or apparent damage, a uniform load equal to that resulting from covering its surface with rectangular flat-bottomed pans filled with water to a depth of 50 mm.

18. DOORS

18.1 Drop doors weighing more than 22 kg shall have a spring, counterbalance or friction control.

18.2 Drop doors shall be such that when opened fully, they will remain essentially in a horizontal position.

18.3 When tested in accordance with **18.3.1**, drop doors, when open, shall be capable of sustaining an applied load of 90 kgf without breakage or permanent deformation for 15 minutes.

18.3.1 The load shall be applied without impact in two equal portions by hanging weights on wires attached to the outer corners of the open door. After the load has been supported for 15 minutes, it shall be removed and the door examined for indication of breakage or deformation.

19. INSULATION

19.1 When insulation is employed, it shall not be exposed to air or flue products, and it shall be uniformly and tightly packed to provide even protection and to prevent shifting.

19.2 Granular insulation shall not be used unless adequately protected against settling during shipment or normal use.

SECTION 2 PERFORMANCE

20. GENERAL CONDITIONS OF TEST

20.1 General conditions of test specified in **18** of IS : 5116-1969* shall apply.

21. GAS CONSUMPTION

21.1 Requirement specified in **19** of IS : 5116-1969* shall apply.

22. IGNITION AND FLAME STABILITY

22.1 Requirements given in **20.1** to **20.5** of IS : 5116-1969* shall apply.

23. THERMOSTATS-FLAME STABILITY AT BY-PASS MAINTENANCE RATE

23.1 Requirements given in **20.6** of IS : 5116-1969* shall apply.

24. COMBUSTION

24.1 Requirements given in **21** of IS : 5116-1969* shall apply.

25. SURFACE TEMPERATURE

25.1 Requirements given in **22** of IS : 5116-1969* shall apply.

26. HEATING CAPACITY

26.1 Commercial ovens and their controls shall be so designed that the oven temperature can be increased from room temperature to 200°C at a minimum average rate of 4°C per minute.

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*General requirements for domestic and commercial equipment for use with LPG.

26.1.1 The gas shall be ignited with the oven at room temperature and the time required to reach 200°C shall be noted. The average heating rate shall be not less than 4°C per minute, and it shall be computed by means of the following formula:

$$\text{Average heating rate} = \frac{200°\text{C} - \text{Room temperature, °C}}{\text{Observed heating time}}$$

26.1.2 The temperature measurement shall be done by a thermocouple placed in the centre of a 5-cm dia blackened copper sphere.

27. MAINTENANCE RATE

27.1 Maintenance of an equilibrium oven temperature of 165°C above room temperature with insulated ovens shall require not more than 1 950 kcal/h/m^3 of oven space when tested according to the method given in Appendix B.

28. OVEN HEAT DISTRIBUTION

28.0 Multiple deck ovens having a single combustion chamber with only one deck controlled by a thermostat shall have this test conducted on only the compartment in which the thermostat sensing element is located. The temperature measurement shall be made by a thermocouple placed in the centre of a 5-cm dia blackened copper sphere.

28.1 The heat distribution in ovens intended for baking or roasting on the deck and in ovens provided with racks for this purpose shall be uniform so that plain layer cakes baked at 190 ± 5°C, for 25 to 30 minutes, unless otherwise specified by the manufacturer, shall be evenly browned. This requirement shall be tested by the method given in Appendix C.

28.2 Ovens intended to prepare special foods or a limited range of similar foods shall show reasonable uniformity of temperature during normal cooking operations as determined by the test prescribed in **28.2.1**.

28.2.1 The food to be cooked shall be prepared in accordance with the recipes provided by the manufacturer and in such quantity as to represent the maximum load that could be placed in the oven. The thermostat dial shall be set at the temperature specified by the manufacturer. When the oven or series of decks has attained equilibrium as indicated by a temperature change of not more than 3°C for 3 consecutive readings, 5 minutes apart, the test load shall be placed in the oven in the manner recommended by the manufacturer. The food shall not be overcooked or undercooked and the entire load shall be uniform in appearance at the end of the recommended cooking time.

29. DOOR RELIEF

29.1 When tested as prescribed in Appendix D doors shall open on applying a pulling force of 22 kgf at each door handle in a direction normal to the plane of the door.

30. DRAUGHT HOODS

30.0 Commercial ovens shall be provided with suitably designed draught hood. When the oven is installed under a mechanically exhausted ventilation hood, a suitably designed flue deflector may replace the draught hood. The performance of the draught hood shall satisfy the tests given in **30.1** to **30.4**.

30.1 With the outlet of the draught hood blocked, the concentration of carbon monoxide shall not exceed 0·01 percent in a room of 28 m^3 with 4 air changes occurring during the combustion of an amount of gas liberating 15 000 kcal. The appliance shall be operated at normal test pressure for approximately 15 minutes and the outlet of the draught hood or draught diverter analysed as in **24.1**.

30.2 When a total down draught pressure ranging from 0 to 1·25 mmH_2O applied at the outlet of the draught hood, it shall not extinguish the main burner flames or cause them to flash back, lift, float, burn outside the appliance, or produce a concentration of carbon monoxide in excess of what is specified in **30.1**. This requirement shall be tested by the method given in **30.2.1**.

30.2.1 The appliance shall be operated for approximately 15 minutes at normal test pressure. Flue pipe of suitable diameter shall be attached to the outlet of draught hood and connected to a blower. The draught in the flue pipe shall be varied from the minimum total pressure available to the maximum value specified above and a sample of products of combustion shall be collected and analyzed as in **24.1**. When the appliance includes more than one separately heated deck or group of decks, this test shall be repeated with such combinations of decks in operation as may be necessary to assure compliance with this provision.

30.3 Downdraughts applied as prescribed in **30.2** shall not extinguish pilot burner flames or cause them to flash back when they are operated separately from the main burners.

30.4 A chimney action consisting of static updraught and velocity updraught numerically totalling between 1·50 and 1·75 mmH_2O applied to the outlet of the draught hood, shall not cause a fractional increase in the volume of flue gases more than twice the numerical sum of the pressure head, and 5 times the velocity head expressed as mmH_2O. This shall be tested by the method given in **30.4.1**.

30.4.1 The appliance shall be tested at normal test pressure for at least 15 minutes. An updraught shall be applied at the outlet of the draught hood such that the numerical sum of the pressure head and the velocity head is between 1·50 and 1·75 mmH_2O. Under this condition a sample of the flue gases shall be taken ahead of the draught hood. The ratio of the carbon dioxide concentration for normal operation as in the combustion test to that under updraught as above shall not be more than $1+2\ (hp + 5\ hv)$ where 'hp' is the pressure head and 'hv', the velocity head. When the appliance includes more than one separately heated deck or group of decks, this test shall be repeated with such combination of decks in operation as may be necessary to assure compliance with this provision.

30.5 Flue gases shall not issue from the relief opening(s) of a draught hood having a vertical outlet when 1·2 metre of stack are attached to, and vertically above the outlet, or from the relief openings of a draught hood having a horizontal outlet when an elbow and 1·5 m of vertical stack are attached to, and above the outlet. A 90° sheet metal elbow with inlet and outlet connections of the same nominal size as the outlet collar of the hood, with no abrupt bends and with a reasonably smooth inner tour, shall be used. This shall be tested as prescribed in **30.5.1**.

30.5.1 The appliance shall be operated at normal test pressure for at least 15 minutes with sections of flue pipe corresponding to the above specifications attached at the outlet of the draught hood. A fuming or smoking material, such as titanium tetrachloride, shall be introduced ahead of the draught hood so as to form a dense smoke. A beam of light shall be directed across the relief opening(s). This provision shall be deemed met when no smoke can be observed escaping from the relief opening(s). When the appliance includes more than one separately heated deck or group of decks, this test shall be repeated with such combinations of decks.

SECTION 3 GENERAL

31. INSTRUCTIONS

31.1 Each oven shall be supplied with an instruction card or cards giving the following information:

a) Clearly defined and complete instructions for lighting and shutting down the appliance on a permanent and rust-resistant plate securely fastened on or adjacent to the controlling device, or in an equally conspicuous position where the instructions can be easily read. Lighting instructions shall include a 5-minute complete shut off period before the appliance is relighted.

b) The commercial baking and roasting ovens shall be accompanied by printed instructions and diagrams adequate for their proper field assembly, installation and safe operation, including those of controls and accessories. These instructions shall be reviewed by the competent authority for accuracy and for compatibility with results of tests from a technical stand-point.

c) Except when electrical equipment is limited to one incandescent lamp fixture, wiring diagrams of all circuits within the appliance shall be permanently attached to the appliance. Some means of colour, letter or number coding shall be used in the diagram to facilitate circuit identification.

d) Brief instruction for installation and regulations and maintenance of the appliance including terminals, if any.

e) Gas consumption in kcal/h.

f) Working pressure of the gas.

g) Any special instruction for correct operation of the appliance.

32. MARKING

32.1 Each oven shall bear a durable rust-proof rating plate fixed to it showing the following:

a) Manufacturer's name, initials or registered trade-mark;

b) Type No. or name;

c) For use with butane/propane at 30gf/cm^2;

d) Manufacturer's normal hourly input/rating of each main burner;

e) Any special instruction for the safe operation; and

f) Country of origin.

32.1.1 The information given in **32.1** shall be distinct, permanent and easily accessible when the oven is installed as it would be in service.

32.1.2 The oven may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

33. PACKING

33.1 The oven shall be packed as agreed to between the purchaser and the supplier taking care of safety requirements during handling and transit.

APPENDIX A

(*Clause* 12.2)

METHOD FOR TESTING STRENGTH OF APPLIANCE (DEFLECTION TEST)

A-1. PRINCIPLE

A-1.1 Application of a horizontal force, or its equivalent, to the uppermost member of the side of the body proper or body frame, relative to the base.

A-1.2 Application of a horizontal force, or its equivalent, to the uppermost member of the front or back of the body proper or body frame, relative to the base.

A-2. PROCEDURE

A-2.1 The legs (or base or both, if removable) and any ornamental finishing strips shall be removed and the body of the oven firmly supported on wooden beams resting on the floor or some equally stable foundation.

A-2.2 Rigid angle iron beams shall be placed on diagonally opposite edges of the body or body frame in such a manner that the upper beam is along the edges of the uppermost member of the body and the lower beam is on the edge of the base of the oven diagonally opposite the upper beam and parallel to it. In the cases where the design of the oven makes it difficult to apply the test exactly as prescribed herein, the arrangement of the apparatus shall be left to the discretion of the testing authority.

A-2.3 Each end of the upper beam shall be connected to the corresponding end of the lower beam by a drawbar in series with a spring balance graduated in not greater than ½ kg intervals.

A-2.4 The tension on each drawbar shall be increased until the readings of the two scales are equal and their sum when converted in terms of a horizontal force is equal to 180 kgf. The sum of the scale readings equivalent to a 180 kgf will depend on the dimensions of the body and may be computed by the following formula:

$$S = \frac{180\sqrt{W + H}}{W}$$

where

S = the sum of the readings of the two scales,

W = the horizontal distance between the vertices of the upper and lower angle iron beams, and

H = the vertical distance between the vertices of upper and lower beams.

A-2.5 Deflection readings shall be made with two Ames dials or similar instruments graduated to 0·025 mm, located on the extreme ends of the uppermost edge of the oven body opposite and in the same horizontal plane as the 180 kgf horizontal force. The temporary deflection shall be considered as the average of the readings of the two instruments in each case and it shall in no case exceed 2·5 mm.

APPENDIX B

(*Clause* 27.1)

TEMPERATURE MAINTAINING TEST

B-1. PROCEDURE

B-1.1 The appliance under test shall be set up to operate as far as possible in the manner expected in normal use, attention being paid to the manufacturer's instructions. It shall be connected to the gas supply at a pressure between 25 and 35 gf/cm^2. The oven temperature shall be brought to and maintained at 165°C above room temperature. The temperature measurement shall be made by a thermocouple placed in the centre of a 5-cm dia blackened copper sphere. The gas consumption shall then be measured over a period of one hour. The oven temperature shall be deemed constant if the temperature readings do not vary by more than 5°C during this one hour period. The oven maintaining rate shall be determined by the following formula:

$$\text{Oven maintaining rate} = \frac{HQK}{V}$$

where

H = net heating value of gas in kcal per litre,

Q = volume of gas burned in litre,

K = 1·0 for direct fired oven and 0·875 for indirect ovens, and

V = volume of oven (cubic metres).

APPENDIX C

(*Clause* 28.1)

OVEN HEAT DISTRIBUTION-CAKE BAKING TEST

C-1. PROCEDURE

C-1.0 The number of cakes made shall be as specified by the manufacturer but not less than 11 per square metre of deck or rack area (sectional areas are not to be considered). Knock out bottom type aluminium (0·711 mm thick) cake pans, 200 mm in diameter and 40 mm in depth shall be used.

Each cake pan shall contain 360 g of cake batter, in ovens intended for baking or roasting on the deck, the cakes shall be baked on the deck. In ovens provided with racks, the cakes shall be baked on the deck. In ovens provided with racks, the cakes shall be on a rack in the position nearest to the centre of the oven. The pans shall be symmetrically located and spaced as evenly as possible with respect to each other and the sides, front and rear of the oven. The time required to open the oven door, insert the cake pans and close the oven door, shall not exceed 30 seconds. The cakes shall be baked for 25 to 30 minutes unless otherwise specified by the manufacturer, removed from the oven, cooled to room temperature and measured for reflectance.

C-1.1 Ingredients — The recipe for cake batter sufficient for five cakes is as follows:

Hydrogenated vegetable oil shortening	231 g
Vanilla	13 ml
Granulated sugar	500 g
Egg	5
Milk	440 ml
Sifted soft wheat (cake flour)	531 g
Retarded action baking powder	20 g
Salt	6 g

C-1.2 Method — Baking powder and salt shall be added to flour, sifted together 3 times and divided into 3 portions. Milk shall be divided into 2 parts. Bottom of pans shall be greased. A three-speed mixer equipped with an off-centre flat beater shall be used in all mixing operations, high speed shall provide 600 rotations per minute; medium, 325 per minute and low speed, 250 per minute. Mixing of all ingredients shall be done in a mixing bowl 200 mm in diameter and 165 mm in depth. Put shortening and vanilla in mixer bowl. With beater operating at high speed, add sugar gradually over a period of 1 minute. Stop mixer and scrape sides of the bowl. Beat for 1 minute longer at high speed. Turn to medium speed and add unbeated eggs gradually over a period of 1 minute. Stop the mixer and scrape the bowl. Turn mixer to low speed adding one-third of the dry ingredients over a period of one minute and half milk over a period of 30 seconds. Stop the mixer at the end of the second addition of flour, scraping down the sides quickly. At the end of the third addition of flour, stop the mixer, scrape down the sides of the bowl, turn to medium speed and beat for 10 seconds longer. Pour the batter quickly into the pans smoothing evenly and rap each pan sharply 3 times on the table to remove the bubbles.

C-1.2.1 When removed from the oven allow cakes to stand in pans for 3 minutes, then turn out on cake coolers.

APPENDIX D

(*Clause* 29.1)

METHOD OF TEST FOR DOOR RELIEF

D-1. PROCEDURE

D-1.1 The oven thermostat shall be set at 260°C and it shall be operated for 30 minutes before applying the test. A weight of 22 kg shall be attached to a point adjacent to the door handle by means of a wire which extends over a pulley, the initial direction of pull being perpendicular to the plane of the door. The door shall open easily when the load is applied without jerk.

D-1.1.1 As an alternative, the load may be applied by means of a spring balance held horizontally and attached to the door. When the handle is of such nature that the application of the load on it will not tend to disengage the door latching mechanism, the wire or spring scale may be attached to the handle. This test shall be conducted at normal test pressure.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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